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PHOTO MASK

[Foto Masuku]

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Specification

1. Title of the invention

PHOTO MASK

2. Patent Claim

A photo mask characterized,

With regard to a photo mask obtained by processing a transparent material such as a glass or quartz, etc. into a flat sheet and by forming a pattern of a metal or metal oxide on the surface of said sheet,

By the fact

That said photo mask is shaped by rounding the four corners thereof.

3. Detailed explanation of the invention

The present invention concerns a photo mask which is used for the pattern formation of a photoresist in the context of manufacturing a semiconductor.

As far as processes of the prior art for manufacturing a semiconductor device are concerned, thermal oxidation & diffusion processes and photoresist etching processes are repeatedly executed, and in particular, a photoresist process whereby a pattern is etched on the surface of a semiconductor substrate plays an extremely important role and is often considered to

¹ Numbers in the margin indicate pagination in the foreign text.

constitute the marrow of the manufacture of a semiconductor device. As far as the role of the photo mask during this photoresist process is concerned, a photosensitizer resin for pattern formation is coated on an oxide film or metal deposition film formed above a semiconductor substrate, and after said semiconductor substrate and a photo mask have been laminated, an exposure operation is carried out, and a pattern becomes formed during a subsequent development process. In other words, the quality of the photo mask hereby used directly affects the performances & yield of the final semiconductor device, and accordingly, the requirements for the photo mask are becoming more demanding every year. At present, one with a square shape is being used as said photo mask, although such a shape is problematic in that its sharp four corners tend to become chipped, accompanied by the generation of small glass fragments, and/or that a mask storage box becomes shaved by said sharp four corners, accompanied by the adhesion of the concomitantly generated fragments & debris to the photo mask, which results not only in the blockage of ultraviolet rays by them during printing & transfer processes but also in the persistence of a residual pattern within a targeted removal site, and/or that the debris, etc. become adhered directly to the semiconductor substrate, and since they contribute to the generations of pinholes & scratches, the yield loss and quality loss of the semiconductor device become unavoidable.

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The objective of the present invention is to provide a photo mask which is virtually unaccompanied by the generations of glass fragments and debris of a mask storage box.

The photo mask of the present invention is a photo mask characterized, with regard to a photo mask obtained by processing a transparent material such as a glass or quartz, etc. into a flat sheet and by forming a pattern of a metal or metal oxide on the surface of said sheet, by the fact that the shape of said photo mask is equivalent to the shape obtained by rounding the four corners of the square photo mask of the prior art.

Unlike the photo mask of the prior art, the sharp four corners of the photo mask of the present invention are rounded, based on which it becomes possible to mitigate not only the scatter of chipped glass fragments which would otherwise tend to become generated from sharp portions but also the generation of debris due to the friction of such sharp portions with a mask storage box. For the purpose of ensuring the contiguity between the semiconductor substrate and photo mask during a pattern duplicating operation, furthermore, vacuum suction is carried out, and in such a case, severely warped local areas become minimized as a result of the rounding of the four corners, as a result of which a homogeneous & virtually radial warp arises instead.

Next, an application example of the present invention will be explained with reference to figures.

Figure 1 is a plane view diagram of a photo mask provided for explaining the prior art. As Figure 1 indicates, the photo mask

of the prior art possesses, on the surface of the photo mask substrate (1), which is made of a glass or quartz, etc. and formed in a square shape, not only the semiconductor element pattern (2) but also sharp four corners (3), which are inherent in the square shape.

In contrast, the photo mask of the application example of the present invention is, as Figure 2 indicates, a photo mask which possesses, on the surface of the photo mask substrate (4) made of a glass or quartz, etc., not only the semiconductor element pattern (2') but also the rounded & curvy four corners (5).

According to this application example, the photo mask substrate (1) used in the prior art is substituted with the peculiarly shaped photo mask substrate (4) of the present invention, and since the sharp four corners (3) have hereby become eliminated, the generation of chipped glass fragments virtually unavoidable in the prior art can be minimized, and furthermore, the generation of debris, etc. attributed to the friction of said sharp four corners (3) with a mask storage box can be mitigated in a case where [the photo mask is] imported into and exported from said mask storage box, and accordingly, pattern pinholes, scratches, and pattern residues attributed to such fragments, debris, etc. can be mitigated. In a case where [said photo mask is] laminated with a semiconductor substrate, furthermore, the overall warp of the photo mask becomes virtually radial, and in particular, since the generations of severely warped local areas can be inhibited, it becomes possible to alleviate the problems of

the warps of individual semiconductor element units formed above the semiconductor substrate as well as the heterogeneity of the alignment of such units both lengthwise & widthwise and, as a result, to improve the yield & quality of the semiconductor device.

4. Brief explanation of the figures

Figure 1 is a plane view diagram which shows a photo mask of the prior art, whereas Figure 2 is a plane view diagram pertaining to a photo mask used for manufacturing a semiconductor device in an application example of the present invention.

Incidentally, the notations denote the following in these figures:

(1): Photo mask of the prior art; (2) & (2) [sic: Presumably "(2) & (2')"] : Semiconductor element patterns; (3): Sharp four corners; (4): Photo mask of the present invention; (5): Four corners articulating curvy planes.

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Figure 1

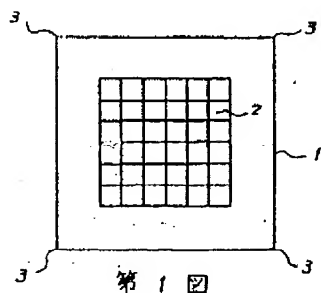
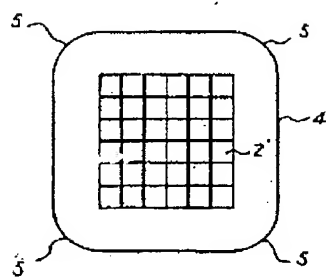


Figure 2



第 2 圖